



NASA Procedural Requirements

COMPLIANCE IS MANDATORY**NPR 7120.5D**Effective Date: March 06, 2007
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Request Notification of Change

(NASA Only)

Subject: NASA Space Flight Program and Project Management Requirements**Responsible Office: Office of the Chief Engineer**[| TOC](#) | [| Preface](#) | [| Chapter1](#) | [| Chapter2](#) | [| Chapter3](#) | [| Chapter4](#) | [| AppendixA](#) | [| AppendixB](#) | [| AppendixC](#) | [| AppendixD](#) |
[| AppendixE](#) | [| AppendixF](#) | [| AppendixG](#) | [| AppendixH](#) | [| AppendixI](#) | [| Figure2-2](#) | [| ALL](#) |**APPENDIX G. Space Flight Project Work Breakdown Structure (WBS)****G.1 Introduction**

G.1.1 The Project Work Breakdown Structure (WBS) is a key element of project management. The purpose of a WBS is to divide the project into manageable pieces of work to facilitate planning and control of cost, schedule, and technical content.

G.2 Assumptions

G.2.1 The WBS standard elements defined in this appendix are only applicable to space flight projects.

G.2.2 The following list of assumptions is provided as background information to assist in the development of the project WBS:

- a. The CADRe captures major assembly (one level lower than subsystem) actuals at major milestones (PDR, CDR, etc.).
- b. There are both political and technical requirement drivers to a WBS.

G.3 Project Business Rules

G.3.1 **Purpose:** The standardization of WBS elements for space flight projects is being driven by requirements for more effective cost estimating and consistency of project work packages across the Agency. The standard WBS is intended to apply to projects, not programs. There are *noprogram* WBS standard requirements due to the variance in structure of the Mission Directorates.

G.3.2 Business Rules:

- a. The standard space flight project WBS applies to new projects established from June 1, 2005, forward. It is not intended to be applied retroactively to existing projects.
- b. The standard space flight project WBS applies to the entire life cycle of the project, including disposal and decommissioning.
- c. The standard space flight project WBS applies to both crewed and robotic projects.
- d. Space flight projects will use the standard Level 1/2 WBS elements (See Section G.5.). Specifically:

(1) The Project Name will be WBS Level 1.

(2) The title of each WBS Level 2 element can be modified to facilitate project-unique titles, but the content of each must remain the same. If the linkage of the project-unique title to the standard title is not intuitive, the project-unique title is cross-referenced to the standard.

(3) If the set of standard WBS Level 2 elements does not comprise an exhaustive set of WBS elements, additional WBS elements may be added horizontally (i.e., at Level 2) as long as their content does not fit into the content of any existing standard WBS elements.

(4) For each standard WBS Level 2 element, the subordinate (children) WBS elements at Level 3 and lower will be determined by the project.

(5) The Level 3 and lower elements can differ from project to project but will include only work that rolls up to the standard WBS Dictionary definition of the Level 2 element. (See Section G.5.)

(6) If there is no work to fit into a standard WBS element, then an inactive placeholder element (and an inactive placeholder financial code) will be established.

(7) A single WBS will be used for both technical/business management and reporting.

(8) The management assigned to each WBS element may differ from project to project.

e. Changes to the standard space flight project WBS will be governed by the waiver approval process in Chapter 3 of this document.

G.4 Space Flight Project WBS Standard Elements

Standard Level 2 WBS elements for space flight projects are shown in Figure G.4-1. The standard WBS template below assumes a typical spacecraft flight development project with relatively minor ground or mission operations elements. For major launch or mission operations ground development activities which are viewed as projects unto themselves, the WBS may be modified. For example, the spacecraft element may be changed to reflect the ground project major deliverable product (such as a facility). The elements such as payload, launch vehicle/services, ground system(s), and mission operations (system) that are not applicable may be deleted.

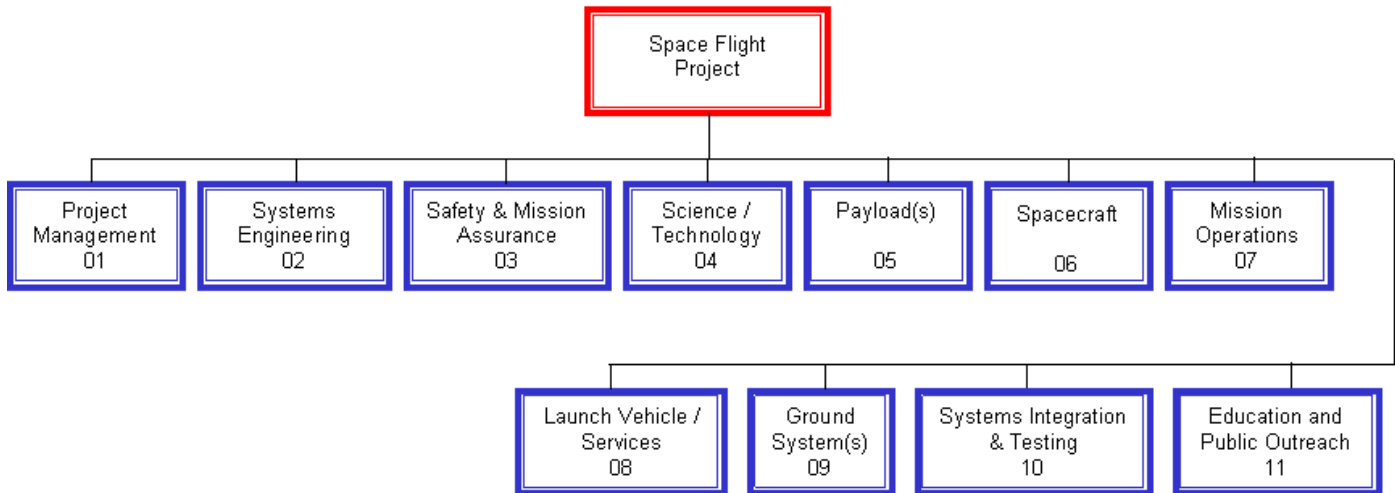


Figure G.4-1 Standard Level 2 WBS Elements for Space Flight Projects

G.5 Space Flight Project Standard WBS Dictionary

Element 1 - Project Management: The business and administrative planning, organizing, directing, coordinating, analyzing, controlling, and approval processes used to accomplish overall project objectives, which are not associated with specific hardware or software elements. This element includes project reviews and documentation, non-project owned facilities, and project reserves. It excludes costs associated with technical planning and management and costs associated with delivering specific engineering, hardware and software products.

Element 2 - Systems Engineering: The technical and management efforts of directing and controlling an integrated engineering effort for the project. This element includes the efforts to define the project space flight vehicle(s) and ground system, conducting trade studies, the integrated planning and control of the technical program efforts of design engineering, software engineering, specialty engineering, system architecture development and integrated test planning, system requirements writing, configuration control, technical oversight, control and monitoring of the technical program, and risk management activities. Documentation products include requirements documents, interface control documents (ICDs), Risk Management Plan, and master verification and validation (V&V) plan. Excludes any design engineering costs.

Element 3 - Safety and Mission Assurance: The technical and management efforts of directing and controlling the safety and mission assurance elements of the project. This element includes design, development, review, and verification of practices and procedures and mission success criteria intended to assure that the delivered spacecraft, ground systems, mission operations, and payload(s) meet performance requirements and function for their intended lifetimes. This element excludes mission and product assurance efforts directed at partners and subcontractors other than a review/oversight function, and the direct costs of environmental testing.

Element 4 - Science / Technology: This element includes the managing, directing, and controlling of the science investigation aspects, as well as leading, managing, and performing the technology demonstration elements of the Project. The costs incurred to cover the Principal Investigator, Project Scientist, science team members, and equivalent personnel for technology demonstrations are included. Specific responsibilities include defining the science or demonstration requirements; ensuring the integration of these requirements with the payloads, spacecraft, ground systems, and mission operations; providing the algorithms for data processing and analyses; and performing data analysis and archiving. This element excludes hardware and software for onboard science investigative instruments/payloads.

Element 5 - Payload: This element includes the equipment provided for special purposes in addition to the normal equipment (i.e., GSE) integral to the spacecraft. This includes leading, managing, and implementing the hardware and software payloads that perform the scientific experimental and data gathering functions placed on board the spacecraft, as well as the technology demonstration for the mission.

Element 6 - Spacecraft(s): The spacecraft that serves as the platform for carrying payload(s), instrument(s), humans, and other mission-oriented equipment in space to the mission destination(s) to achieve the mission objectives. The spacecraft may be a single spacecraft or multiple spacecraft/modules (i.e., cruise stage, orbiter, lander, or rover modules). Each spacecraft/module of the system includes the following subsystems, as appropriate: Crew, Power, Command & Data Handling, Telecommunications, Mechanical, Thermal, Propulsion, Guidance Navigation and Control, Wiring Harness, and Flight Software. This element also includes all design, development, production, assembly, test efforts, and associated GSE to deliver the completed system for integration with the launch vehicle and payload. This element does not include integration and test with payloads and other project systems.

Element 7 - Mission Operations System: The management of the development and implementation of personnel, procedures, documentation, and training required to conduct mission operations. This element includes tracking, commanding, receiving/processing telemetry, analyses of system status, trajectory analysis, orbit determination, maneuver analysis, target body orbit/ephemeris updates, and disposal of remaining end-of-mission resources. The same WBS structure is used for Phase E Mission Operation Systems but with inactive elements defined as "not applicable." However, different accounts must be used for Phase E due to NASA cost reporting requirements. This element does not include integration and test with the other project systems.

Element 8 - Launch Vehicle / Services: The management and implementation of activities required to place the spacecraft directly into its operational environment, or on a trajectory towards its intended target. This element includes launch vehicle, launch vehicle integration, launch operations, any other associated launch services (frequently includes an upper-stage propulsion system), and associated ground support equipment. This element does not include the integration and test with the other project systems.

Element 9 - Ground System(s): The complex of equipment, hardware, software, networks, and mission-unique facilities required to conduct mission operations of the spacecraft systems and payloads. This complex includes the computers, communications, operating systems, and networking equipment needed to interconnect and host the Mission Operations software. This element includes the design, development, implementation, integration, test, and the associated support equipment of the ground system, including the hardware and software needed for processing, archiving, and distributing telemetry and radiometric data and for commanding the spacecraft. Also includes the use and maintenance of the project testbeds and project-owned facilities. This element does not include integration and test with the other project systems and conducting mission operations.

Element 10 - Systems Integration and Testing: This element includes the hardware, software, procedures, and project-owned facilities required to perform the integration and testing of the project's systems, payloads, spacecraft, launch vehicle/services, and mission operations.

Element 11 - Education and Public Outreach: Provide for the education and public outreach (EPO) responsibilities of NASA's missions, projects, and programs in alignment with the Strategic Plan for Education. Includes management and coordinated activities, formal education, informal education, public outreach, media support, and website development.

| [TOC](#) | [Preface](#) | [Chapter1](#) | [Chapter2](#) | [Chapter3](#) | [Chapter4](#) | [AppendixA](#) | [AppendixB](#) | [AppendixC](#) |
[AppendixD](#) | [AppendixE](#) | [AppendixF](#) | [AppendixG](#) | [AppendixH](#) | [AppendixI](#) | [Figure2-2](#) | [ALL](#) |

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